

# FIRE II Cirrus

## Mission Summary



Date: November 22, 199  
Julian Day: 326  
Experiment Day: 10

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### Mission Objective:

Regional development and dissipation of cirrus systems and observation of cloud microphysical, radiative and dynamical properties.

### Mission Description:

Day #2 of First Intensive Observing Period.

- **Large-scale:** Activation of the large scale rawinsonde network (6-hourly observations) and inner mesoscale network (3-hourly observations) will provide a very good test data base for regional models as the widespread cirrus observed yesterday over the western United States had declined and moved failed central United States, where the 3-hourly soundings were being made, as a better defined but less extensive system that developed into a winter storm.
- **Local Operations:** Attempted intensive in situ observations of cirrus clouds coordinated with extensive remote sensing observations at the Hub. Cloud conditions rapidly developed into a messy multi-layered overcast situation. Surface-based observations were largely obscured from cirrus levels. Good early morning (dawn) radiometric and microphysical observations were made by Sabreliner followed by well-coordinated ER-2 remote sensing and UND Citation in situ mission over the Hub. Unfortunately, the data tape for ER-2 Cloud Lidar System was inadvertently mis-loaded resulting in no data collection by this system.

### Weather Synopsis:

Friday was a transition day for weather in southeast Kansas. Following the late night clearing event about 2 a.m. which closed down operations, patchy cirrus increased to a total overcast during the morning hours. However, middle and low level clouds also increased dramatically. By noon, the sky was completely overcast with low and middle level clouds. Winds switched direction from light southwesterly to northwesterly around 11 in the morning as a front passed. Surface temperatures reached the day's high during the morning (upper 40's), and dropped over the rest of the day. A second front passed through in the late afternoon, and by sunset winds increased to over 20 mph with stratocumulus cloud cover and flurries.

### Synoptic Situation:

A major winter storm got underway during the day on Friday. A developing storm moved east from the Rockies in association with an amplifying shortwave trough during the morning hours. Cloud cover over the central midwest increased dramatically at all levels. The storm became well-defined over western Missouri by early afternoon and quickly deepened as it moved toward the Great Lakes region. Precipitation was light and scattered over most of Kansas during the afternoon. Strong northwesterly flow aloft and clearing at middle and upper levels was re-established following passage of the storm. Intrusion of polar air down the lee side of the Rockies led to formation of extensive low level clouds.

Aircraft	Depart	Land	Notes
NASA ER-2	11:00 CST		Worked over hub 12:36 to 2:32 CST, No data taken with cloud lidar system, Narrow fov IR radiometer into the
NCAR King Air			No flight
NCR Sabreliner	7:35 CST	9:55 CST	250deg./80deg. racetracks over Hub, no probs
UND Citation	12:03 CST	15:40 CST	NE/SW racetracks over Hub, no probs

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	20:17:06	47.03	69.96	3-hourly
	10:22:06	46.41	289.47	3-hourly
NOAA-12	14:45:00	34.53	287.25	3-hourly
	02:04:54	49.07	261.33	3-hourly

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### Rawinsonde Operations:

- Inner NWS stations (Type A): Intensive mode @ 12, 15, 18, 21, and 00 UTC
- Outer NWS stations (Type B): Intensive mode @ 12, 18, and 00 UTC
- Hub CLASS station: Intensive mode @ 12, 15, 18, 21, and 00 UTC
  - 15 UTC sonde had ice replicator attached
- Remote CLASS stations: Intensive mode @ 12, 15, 18, 21, and 00 UTC
- Hub GSFC/WFF station: Launches @ 20 UTC
- CSU Parsons station: Launches @ 14, 16, and 18 UTC

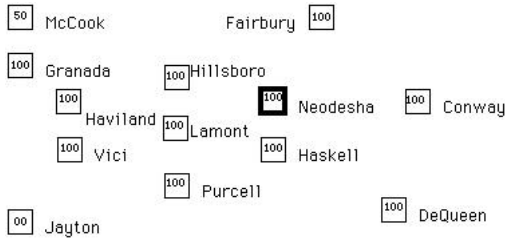
### FIRE Profiler Status:

- CSU 405 MHz @ Parsons: Continuous operation (RASS during midday)
- PSU 50 MHz @ Coffeyville: Evening operation, winds good to 6 km.



- RASS will require post-processing.
- NOAA 405 MHz @ Coffeyville: Not operational

#### NWS Wind Profiler Status:



#### SPECRE Operations:

Intensive operations around midday of low cloud case. 50 MHz problems still exist but system is now operational! although post-processing will be required to retrieve the temperature profile information.

#### Aircrew/Mission Scientist Debrief Notes:

- NCAR SABRELINER: The CO2 lidar observed a dense broken cloud layer between 5 and 7 km, a thin cloud layer at 8 km and a patchy cirrus layer at about 10 km just prior to take-off of this dawn flight. Wind speeds of 140 knots were found at flight level. A series of along-the-wind racetrack flight legs at a heading of 80deg./260deg. were flown over the Hub at 29, 31, 29, 27, 31K' as cirrus cloudiness increased and the middle level cloud became solid. Many slide samples of crystal were taken. The TDDR and SPEARAD data looked real good.
- NASA ER-2: Two long racetracks patterns (20 minute legs ~250 km) were flown in coordination with the UND Citation. All of the flight tracks were oriented roughly along the wind and in the solar plane with the SW end of the pattern anchored on the Hub. The flight coincided with the NOAA-11 overpass although the viewing zenith angle was not good. The data tape for the Cloud Lidar System was not properly loaded and resulted in loss of this data for the entire flight. This was a major setback given the cloud obscuration of the surface-based remote sensors.
- UND CITATION: Along-wind (50deg./230deg.) racetrack patterns with ~30 km legs anchored over the Hub on the downwind end were flown in coordination with the ER-2. We were unaware that the ER-2 had been briefed to orient in the solar plane so coordination was not optimal. Legs were flown at 27, 26, and 25K'. Cloud top was noted to be descending as the cirrus thinned and the altocumulus layer developed. The pattern was then moved 40 miles to the northeast where cirrus cloud conditions were better (still roughly under the ER-2 track) and racetracks were flown at 25, 24, and 23K'. A great variety of cloud forms and microphysics were sampled including multiple penetrations of a very smooth persistent "wave" feature. After the ER-2 departed, a series of cross-wind legs (step-up) were flown at 23, 24, 25, 26, 27, and 28K' in an attempt to get to cloud top (now just above 28K'). The situation was now described as "very messy". Overall, a very successful mission collecting observations of a great variety of cirrus microphysical conditions.

#### Significant Hardware Problems:

- ER-2 Cloud Lidar operator failure - no data.
- ER-2 narrow fov IR radiometer failed - no data
- NOAA 405 MHz profiler not operational.
- PSU/NOAA 50 MHz wind profiler still having some noise problems at upper levels, RASS data should be recoverable
- U.Wisc HSR lidar operating as dual-polarization lidar

#### Highlights of FIRE Operations:

- Collection of an excellent rawinsonde data set for use in regional models - a well-resolved cyclogenesis case with extensive upper and middle level clouds. This case should be quite attractive to the modeling community. A fitting conclusion for the first IOP.
- Good ER-2 observations of developing multilayered cloud system in conjunction with detailed microphysical observations of the overlying cirrus system.

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#### Instrument Logs

Active Sensor	Active Sensors																							
	UTC Hour																							
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11
Utah Lidar H																								
LaRC Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wisc HSR Lidar H				X	X	X	X																	
Wisc Vol Image Lidar				X	X	X	X	X	X															
GSFC RAMAN Lidar H																								
NOAA CO2 Lidar H	X	X	X	X	X	X	X																	
NOAA Radar H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PSU Radar H	X	X	X	X	X	X	X	X	X	X	X	X												
PSU Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PSU 50 MHz Wind Prof H										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PSU/NOAA 50 MHz RASS H										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NOAA 405 MHz RASS H																								
LaRC Lidar P	X	X	X	X	X																			
CSU Wind Prof/RASS P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

